Basis for Development of Technology-Based Numeric Nutrient Limits in the Proposed February and July 2011 Drafts of Reg. # 85

Colorado Water Quality Control Division

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1.0 INTRODUCTION

The Water Quality Control Division (Division) proposed technology-based numeric nutrient limits for point source discharges as part of the proposed Nutrients Management Control Regulation (Regulation No. 85) for which draft versions were released on February 2, 2011 and a revised version on July 5, 2011. Each revision's published technology-based numeric nutrient limits and associated compliance monitoring periods reflect incremental progress toward a final draft proposal based on the Division's interpretation and compilation of facts from published literature, stakeholder comments, focused sub-group discussions, parallel development of numeric nutrient criteria occurring in other states, and the work of a technical committee comprised of independent consulting engineers. The Division is proposing a technology-based approach, as opposed to a strict water quality-based approach to nutrient control in Colorado as it will proceed farther and more expeditiously by focusing the primary control efforts over the next decade.

The purpose of the document is to outline the thought process used to develop and modify the draft technology-based numeric nutrient limits. Because of substantial stakeholder involvement, the body of this document acts as a summary of Division efforts while specific information regarding stakeholder concerns and the Division's consideration of those concerns is provided in appendices. The Division's development of the initial and revised proposed technology-based limits for domestic wastewater treatment plants and non-domestic discharges, which that are likely to have significant levels of nutrients in their discharges, has occurred in three main steps:

1. Development of the initial technology-based numeric nutrient limits.
2. Receipt of stakeholder comments and an independent consulting engineer evaluation.
3. Development of revised (currently proposed) technology-based numeric nutrient limits.

Each of these major process steps is discussed in the following section of this document.

2.0 DEVELOPMENT OF THE INITIAL TECHNOLOGY-BASED NUMERIC NUTRIENT LIMITS

The Division's first step in formulating technology-based numeric nutrient limits came about in December 2010 with the issuance of *Technologies, Performance and Costs for Wastewater Nutrient Removal and Implementation Recommendations* (Nutrient Treatment White Paper). This document

- summarized the latest available peer-reviewed literature and presented findings related to the nutrient removal capabilities of commonly used biological and chemical processes at domestic wastewater treatment facilities,
- offered recommendations for the application of the literature findings specific to the development of technology-based numeric nutrient limits in Colorado, and
- served as a foundation for the published technology-based numeric nutrient limits in the February 2011 version of Regulation 85.

The Division was hopeful that this document would be useful for initiating discussions regarding numeric nutrient limits while providing a defensible approach based on peer-reviewed documentation.

The Nutrient Treatment White Paper discusses the technical basis for establishing the technology-based numeric nutrient criteria. Three key concepts materialized during the development of the White Paper:

1. Limits of Technology: Technology-based numeric nutrient limits must be chosen based on a selected level of technology.
2. Compliance Monitoring: Compliance monitoring periods are essential to the development of technology limits.
3. Guiding Principles: An initial implementation plan with supporting goals is essential to guide the balance between technology based limits and other critical factors such as the compliance monitoring period and cost.

Each of these topics is discussed individually below.

2.1 Limits of Technology

One of the primary goals in developing the Nutrient Treatment White Paper was to establish the technologically achievable treatment capabilities for biological and chemical treatment systems used for nitrogen and phosphorus. Due to the variety of treatment configurations and combinations of treatment processes, a single overriding numeric nutrient limit for nitrogen and phosphorus is not feasible. As such, the Division established seven (7) treatment bins by which to classify specific treatment processes according to nutrient treatment capabilities. Information from the peer-reviewed references was then used to directly populate the reliable process performance treatment capabilities of each treatment technology bin. In general, as the bin value increases, the process complexity, overall capital and operational cost, and treatment capability increases. A summary of the bin classification system and the associated limits is found in Table 4 Technology Statistics by Treatment Bins of the Nutrient Treatment White Paper (Table 4).

The information presented in Table 4 of the Nutrient Treatment White Paper became a main focal point during the initial development of technology-based numeric nutrient limits presented in February 2011 in the draft version of Regulation 85. Table 4 enabled the Division to evaluate the level of technology necessary to achieve specific numeric nutrient effluent concentrations suitable for the first stage of implementation of a nutrients control strategy.

2.2 Compliance Monitoring Periods

The development of Table 4 led the Division to conclude that compliance monitoring periods cannot be dissociated from the numeric nutrient limits. While each treatment technology has an associated technological capability, treatment systems do not continuously operate at their optimal treatment capability. Accordingly, the expected variability of each treatment system must be accounted for by using an appropriate compliance monitoring period. The peer-

reviewed references considered several ways of evaluating and accounting for the reliability of treatment systems including the coefficient of variation (COV) and the technology performance statistic (TPS). Based on the Division's interpretation, the TPS system not only appeared to have the most complete method of relating technology limits to specific compliance periods, but also aligned well to direct application within the Colorado Discharge Permit System. As such, the Division used the TPS system to formulate the expected range of reliable treatment for each treatment bin.

While more thoroughly described in the Nutrient Treatment White Paper, the Division extracted reliably achievable treatment limits for nitrogen and phosphorus associated with specific treatment processes (bins) from the information presented in referenced material and equated those limits to Reliable Process Performance (TPS-95%). From the Reliable Process Performance, the Division calculated the Average Process Performance (TPS-50%) and the Best Achievable Performance (TPS-14d). This information is also presented in Table 4.

While the TPS-14d is an important statistical parameter, the Division focused on the TPS-95% and TPS-50% values for the development of the technology-based numeric nutrient limits. The TPS-50% represents the concentration achieved on a statistical annual average. The TPS-95% represents the effluent concentration reliably achieved 95 percent of the time. The Division found that the TPS-50% and TPS-95% values were appropriate for directly establishing a long running annual average and an upper compliance threshold effluent limit, respectively. To establish a reasonable upper compliance threshold effluent limit, the TPS-95% values must be appropriately matched with the correct monitoring and compliance periods necessary to compensate for excursions expected 5 percent of the time.

To implement the TPS-50% and TPS-95% technology based limits, the Division determined that the compliance monitoring periods must align with the TPS model while providing a regulatory cushion that still necessitates continuous treatment to achieve compliance. The Division proposed a rolling annual average to align with the TPS-50% and a rolling quarterly average for the TPS-95%. The rolling quarterly average for the TPS-95% was established to balance out the anticipated excursions that are expected to occur 5% of the time.

The initial literature-based and calculated achievable nutrient limits found in Table 4 represented the foundation for developing the first draft of technology-based numeric nutrient limits for well operated, maintained, and engineered nutrient treatment facilities based on the data from facilities evaluated through peer-reviewed research.

2.3 Guiding Principles

Following the development of the technology types and TPS values associated with each treatment bin, the Division established the following goals to help set the pathway toward initial technology-based numeric nutrient criteria:

- Develop technology-based numeric nutrient limits that can be reliably achieved using well engineered, operated, and maintained wastewater treatment processes.
- Determine reasonable technology-based numeric nutrient limits expectations that promote immediate improvements in nutrient treatment leading to improved surface water quality.
- Encourage facilities to choose and plan for treatment processes that enable facilities to make incremental process improvements over time to enhance the level of nutrient treatment.
- Encourage facilities to provide biological treatment of nitrogen and phosphorus before reliance on chemicals to meet technology-based numeric nutrient limits.
- Establish the compliance monitoring period to encourage substantial treatment improvements without causing significant non-compliance among the regulated community.
- Consider appropriate compliance buffers dependent on the numeric nutrient limit implementation.

2.3.1 Minimum Technology Requirements

As an initial step toward meeting these goals, the Division recognized that the majority of mechanical wastewater facilities within the state of Colorado use some form of activated sludge for secondary treatment. Many of those facilities have already incorporated an anoxic zone ahead of the aerobic zone to gain the benefits of a preliminary denitrification process as in the Modified Ludzack-Ettinger (MLE) treatment system. The Division further recognized that the MLE process is a building block from which higher level treatment processes can be built. For example, biological nutrient removal of phosphorus can be achieved by incorporating an anaerobic zone ahead of an MLE treatment system to create what is commonly known as the 3-stage Phoredox or A2O treatment system.

Since the MLE and A2O processes are also the initial building blocks of other even more sophisticated enhanced nutrient treatment approaches, the Division initially focused on Bin 3 and Bin 4 treatment processes as the first steps toward building a nutrient removal treatment system. Using Bin 3 and Bin 4 treatment systems as the foundation of the technology-based numeric nutrient criteria appeared to satisfy a number of the guidelines established by the Division, and helped direct the Division's approach. At this time, few existing facilities in Colorado appear to have the treatment processes in place to reliably achieve the technology-based numeric nutrient limits shown in Table 4. The Division found that achieving that level of treatment would require significant capital outlay. The Division felt this approach was too costly for a first implementation step. As such, the Division proposed that Bin 3 be use as the basis for the first

implementation phase for upgrading existing facilities with the associated technology-based numeric nutrient limits in the Nutrient Treatment White Paper. Existing facilities often have site limitations and problems with infrastructure that constrain treatment upgrades. However, the Division considered that new facilities should be required to meet the more stringent technology-based numeric nutrient limits associated with Bin 4 treatment processes since the technology is readily available and implementable for new facilities.

Table A summarizes performances estimates published in Table 4 for Bin 3 and Bin 4 levels of treatment.

Table A. Treatment Bin Performance Summary

Treatment Bin	Parameter	Process Performance Limit	
		TPS-50% (Running Annual Average)	TPS-95% (Running Quarterly Average)
Bin 3, Biological Nutrient Removal	Total Phosphorus	0.7 mg/L	1 mg/L
	Total Nitrogen	6.7 mg/L	10 mg/L
Bin 4, Enhanced Biological Nutrient Removal	Total Phosphorus	0.7 mg/L	1 mg/L
	Total Nitrogen	4 mg/L	6 mg/L

As derived from reference material, the total phosphorus technology-based numeric nutrient concentrations do not improve between Bins 3 and 4. Again, the Division considered that new treatment facilities should be required to provide a higher level of treatment since the technology for meeting the limits is readily available and new facilities face fewer design challenges. Accordingly, the Division chose the technology-based numeric phosphorus limit from Table 4, Bin 5 for new wastewater treatment facilities for incorporation into Regulation 85. The Table 4, Bin 5 values for phosphorus are 0.65 mg/L for TPS-95% and 0.43 mg/L for TPS-50%.

2.3.2 Accounting for Recalcitrant Nutrients

In addition to setting appropriate compliance monitoring periods, the Division evaluated the appropriate measure of nitrogen upon which to set technology-based nutrient removal requirements. The literature reviewed provided information on the removal of total nitrogen by the evaluated wastewater treatment facilities. Total nitrogen measurements include all forms of organic and inorganic nitrogen present in the treated effluent. The literature indicates that organic nitrogen, which is not readily removed by biological nutrient removal (BNR) treatment processes, is usually a relatively small fraction (0-2.5 mg/l) of the total nitrogen (25-40 mg/l or more) in the wastewater influent. The Division, in evaluating an appropriate measure to assess performance of BNR technology, determined that the limits should be based on the fraction of

total nitrogen that BNR treatment is capable of removing (inorganic nitrogen). This determination ensures that variations in influent organic nitrogen concentrations and their biodegradability do not effect compliance with the limitations. The Division realizes that some fraction of the discharged organic nitrogen may become bio-available in the receiving water and anticipates that as criteria and standards are established for nitrogen in the future, water quality standards based effluent limits will be set for total nitrogen in the effluent. As such, the Division set the proposed total inorganic nitrogen limit based on the Table 4, Bin 3 total nitrogen limit reduced by 1 mg/L of recalcitrant organic nitrogen. This amount of organic nitrogen was cited in literature as being the upper limit for the majority of domestic wastewater facilities, nationally. The resulting technology-based numeric nutrient limits published in the February 2, 2011 draft of Regulation 85 for existing and new facilities are shown in **Table B.**

Similar adjustments were not made for phosphorus because concentrations of recalcitrant organic phosphorus are generally very low and have not been identified as a concern for achieving effluent limits in the range being considered by the Division.

Table B. February 2011 Proposed Technology-Based Numeric Nutrient Criteria

Facility Status	Parameter	Process Performance Limit	
		TPS-50% (Running Annual Average)	TPS-95% (Running Quarterly Average)
Existing Domestic Wastewater Treatment Facility	Total Phosphorus	0.7 mg/L	1 mg/L
	Total Inorganic Nitrogen	5.7 mg/L	9 mg/L
New Domestic Wastewater Treatment Facility	Total Phosphorus	0.43 mg/L	0.65 mg/L
	Total Inorganic Nitrogen	3.0 mg/L	5.0 mg/L

3.0 STAKEHOLDER COMMENTS AND INDEPENDENT CONSULTING ENGINEER EVALUATION

Following issuance of the draft effluent limits in February 2011, stakeholders provided written and verbal comments during work group and sub-group meetings. As already mentioned, an independent consulting engineer evaluation was also provided. These comments and findings were helpful as the Division began to consider making revisions to the proposed numeric nutrient limits. Stakeholder comments, directly related to the numeric nutrient limits, raised concerns about whether the technology-based numeric nutrient limits had been adequately justified; and whether the proposed compliance monitoring periods for the proposed technology-based numeric nutrient limits were appropriate. These issues are summarized within this section. Appendix I

and Appendix II provide additional information regarding the stakeholder comments, the independent consulting engineer evaluation, as well as the Division's responses to specific concerns.

3.1 Concern: Are Proposed Numeric Nutrient Limits Justified?

Many stakeholders questioned whether the proposed nutrient limits developed through the literature review were justified. Stakeholders had concerns that the literature used to develop the technology-based numeric criteria (1) may not well represent Colorado specific wastewater treatment challenges (e.g. low wastewater temperature conditions), (2) may misrepresent nutrient treatment capabilities due to unknown influent loading characteristics compared to the overall design capacity of the domestic wastewater treatment works, and (3) may overestimate treatment capabilities of simultaneous nitrogen and phosphorus treatment systems by using data associated with facilities primarily designed and optimized for either nitrogen or phosphorus treatment.

As part of the stakeholder discussion, an independent consulting engineering evaluation was performed to provide an independent assessment of nutrient treatment capability at Colorado facilities to compare to the Division's technology-based numeric nutrient criteria recommendation. The Effluent Limits Sub-Group discussed the approach for the engineering review and determined that it should develop technology-based numeric nutrient removal expectations for Bin 3 (existing) and Bin 4 (proposed) type treatment processes without the use of chemical additives as described in the Nutrient Treatment White Paper. The reasoning behind this direction was that the draft limits in the Division's February version were based on the treatment provided by facilities included in these two bins. The independent consulting engineering evaluation proposed significantly different limits than the technology-based numeric nutrient limits proposed in the February 2011 edition of Regulation 85. The proposed technology-based numeric nutrient limits included as part of the Decision Support Document prepared by the independent consulting engineering evaluation are shown in **Table C.**

Table C. Independent Consulting Engineering Evaluation Recommended Technology-Based Numeric Nutrient Criteria

Facility Status	Parameter	Process Performance Limit	
		Annual Median	Annual 95th Percentile
Existing Domestic Wastewater Treatment Facility	Total Phosphorus	1.5 mg/L	3.0 mg/L
	Total Inorganic Nitrogen	15 mg/L	20 mg/L
New Domestic Wastewater Treatment Facility	Total Phosphorus	1.0 mg/L	2.0 mg/L
	Total Inorganic Nitrogen	10 mg/L	15 mg/L

3.2 Concern: Are the Proposed Compliance Monitoring Periods Appropriate?

Additionally, the stakeholders expressed concern regarding the compliance monitoring statistics and period(s) for technology-based numeric nutrient limits. Since achieving the technology-based numeric nutrient limits is highly dependent on the proposed compliance monitoring statistics and periods, the stakeholders felt that the compliance monitoring periods needed to be set to provide more flexibility for achieving compliance recognizing that biological treatment systems, particularly BNR, will have effluent excursions when effluent limits are set near the abilities of a specific treatment technology. The stakeholders suggested using medians instead of averages and not using rolling averages to eliminate long term non-compliance due to single or short periods of high effluent concentrations.

Similarly, comments suggested that the Division provide more flexibility for existing nutrient removal facilities. A number of existing nutrient removal facilities within Colorado indicated that the proposed technology-based numeric nutrient limits for existing facilities could not be met by the existing facility. These facilities indicated that treatment is limited by their existing basin size and/or by higher influent concentrations which exceed the facilities original design basis. These systems have requested that the Division consider an alternate approach that follows the lead of the European Commission (EC). The EC has implemented regulations for a set effluent concentration and a minimum percentage reduction of nutrients. The fixed effluent limit and/or the percent removal are used to regulate a facility based on the condition of the receiving stream. As proposed by the engineers, the percent reduction between the influent and effluent nutrient concentrations would provide an alternate option for existing systems that receive wastewater with a high nutrient concentration.

4.0 DEVELOPMENT OF REVISED (CURRENTLY-PROPOSED) TECHNOLOGY-BASED NUMERIC NUTRIENT LIMITS

In the first draft of Regulation 85, the Division proposed literature supported technology-based numeric nutrient limits. Feedback from stakeholder comments indicated that these initial proposed technology-based numeric nutrient limits did not fully account for Colorado specific challenges and needs. The Division carefully considered stakeholder comments and sought out additional information necessary to reevaluate its earlier proposal.
As a result of these efforts, the Division issued a second version of Regulation 85 in July 2011 that included revised technology-based numeric nutrient limits and associated compliance monitoring outlined in Table D.

Table D. July 2011 Proposed Technology-Based Numeric Nutrient Criteria

Facility Status	Parameter	Process Performance Limit

		Annual Median	Semiannual Median: Jan-June; July-Dec
Existing Domestic Wastewater Treatment Facility	Total Phosphorus	1.0 mg/L	1.25 mg/L
	Total Inorganic Nitrogen	10 mg/L	15 mg/L
New Domestic Wastewater Treatment Facility	Total Phosphorus	0.7 mg/L	1.0 mg/L
	Total Inorganic Nitrogen	7 mg/L	10 mg/L

The following discussion summarizes the Division's thought process and information used to arrive at the revised limits. A more detailed discussion of the Division's consideration of specific stakeholder comments and the additional information sought out and considered by the Division is outlined in Appendix I and Appendix II.

4.1 Stakeholder Comments and Division Response/Consideration

The Division carefully considered the stakeholder comments that directly related to the development of the technology-based numeric nutrient limits. While the Division did not agree with all comments, a substantial number of stakeholder comments spurred the Division to consider the need to raise the minimum technology-based effluent limits and adjust the associated compliance monitoring statistics/period. The following information highlights Division's appraisal of specific concerns:

- Temperature: The Division found that new facility designs can accommodate lower temperatures found in Colorado and still achieve the limits of technology. For existing facilities not currently designed for nutrient removal, low temperature may limit the ability of existing treatment plants to meet the proposed technology-based numeric nutrient limits when using existing basins. The Division specifically considered temperature when increasing the technology-based numeric limits for existing domestic wastewater treatment facilities.
- Influent Wastewater Characteristics: The stakeholder comments and Effluent Limits Sub-Group findings caused the Division to rethink its initial position of attempting to limit the scope of the technology-based numeric nutrient criteria for no chemical addition. The Division recognized that facilities must often use chemicals to optimize the influent characteristics for nutrient removal and/or add specific chemicals to help enhance treatment processes or compensate for process upsets. The Division is still supporting the primary use of biological treatment, but has found it appropriate to include chemical feed as a design aspect of the "characteristic" facility upon which the effluent limits for existing and new facilities are based. This approach is appropriate since the levels identified by the Division in the July version appear achievable with the inclusion of chemical feed as a back-up or to address situations where operational constraints mandate

the addition of chemicals. The Division did consider this aspect in adjustment of the technology-based numeric nutrient limits.

- Influent Wastewater Loading: The stakeholders indicated that the literature used as the basis for the first draft of the technology-based numeric nutrient limits did not establish the current loading as a percentage of design treatment capacity for each facility cited in the studies. Under-loaded wastewater treatment facilities are better equipped to treat beyond the design expectations of the facility due to the ability to establish longer detention times and higher recycle ratios. The Division considered this concern when revising the technology-based numeric limits for existing domestic wastewater treatment facilities. As a note, the majority (approximately 80 percent) of the mechanical wastewater treatment facilities within Colorado receive influent flows less than 60 percent of their design hydraulic capacity. The majority of mechanical treatment facilities within Colorado are currently positioned to provide a higher level of treatment than at design loadings.
- Combined versus Separate Nutrient Treatment Processes: The stakeholders indicated that the literature used as the basis for the first draft of the technology-based numeric nutrient limits did not address whether the studied facilities used combined or separate nutrient treatment processes. Separate nutrient treatment processes generally enable better removal than combined nutrient treatment processes. Considering that most Colorado wastewater treatment facilities will initially provide combined nutrient removal because of the specific requirements of Regulation 85. the Division addressed this concern when revising the technology-based numeric limits for existing domestic wastewater treatment facilities.
- Compliance Buffers: The stakeholders suggested medians instead of averages, removal of rolling compliance periods, and consideration of a percent removal concept instead of set limits. The Division incorporated annual medians and eliminated the rolling quarterly compliance periods, but did not fully address the implications of the percent removal concept prior to the July 2011 Regulation 85 revision. The Division agreed with the stakeholders regarding the implemented compliance changes and needs to further review the percent removal concept.

4.2 Supporting Information Evaluated by the Division

In consideration of potential numeric nutrient limit changes, the Division performed additional investigations to better define the appropriate technology-based numeric nutrient limits. These investigations included treatment process modeling, review of recent papers that support effluent limits for three stage BNR generally consistent with the Division's July proposal, and consideration of the technology-based numeric nutrient process occurring in Montana.

4.2.1 Limited Simulation Modeling

As part of the parallel cost-benefit study, the contract between the lead consultant, CDM, and the Division allowed for some wastewater treatment simulation modeling. The Division used a portion of this modeling time to evaluate the theoretical nutrient reduction capabilities of the Bin 3 and 4 processes under conservative Colorado conditions to establish another boundary condition with which to further bracket the technology-based numeric nutrient limits. The Division reviewed the MLE, A2O, and 3-stage Bardenpho (without effluent filtration) treatment processes as part of the simulation effort. Since the limits will apply throughout the state and modeling simulation time was limited, the selected conditions for the model runs were intended to provide a reasonable estimate for the most significant challenges faced throughout the state including low wastewater temperatures, relatively high influent nutrient loadings, and applicability of supplementary chemical feed systems.

The model simulations best represent new wastewater treatment facilities with the standardized design parameters identified in Table E.

Table E. Fixed Simulation Inputs

Fixed Input Parameter	**Value**
Temperature	8°C
Influent Total Suspended Solids	240 mg/L
Influent Biochemical Oxygen Demand	250 mg/L
Influent Hydraulic Load	Steady State Maximum Month Load
Mixed Liquor Suspended Solids (MLSS)	3500 mg/L
Solids Retention Time	14 days
Influent Total Kjeldhal Nitrogen Load	53 mg/L
Influent Ammonia Load	40 mg/L
Influent Total Phosphorus Load	6 mg/L
Return Activated Sludge Return Rate	100% of average daily flow
Internal Recycle Rate	400% of influent flow
Secondary Clarifier Design	Ideal to achieve overflow TSS of 10 mg/L
SVI	180 mg/L

The Division reviewed the modeling results, but did not use the results to establish specific technology-based numeric nutrient limits. Instead, the Division used the general trends to reset its thinking about the initial treatment bin designations and, its initial approach that the limits be based on biological treatment without considering chemical addition.

The results indicate that MLE wastewater treatment processes faced with a high influent nutrient loading may have difficulty meeting the proposed technology-based numeric nutrient criteria without sufficient basin volume to promote longer solids retention times. The A20 and Bardenpho treatment processes were able to meet the proposed technology-based numeric nutrient limits when sufficient tank volume was available. Interestingly, the effluent results for the MLE process without chemical addition resemble the proposed technology-based numeric

nutrient limits proposed by the independent consulting engineers. With this finding, the Division refined its approach and decided to include chemical feed as an option for achieving nutrient limits. When chemical addition is provided, which comes at a relatively low capital cost, all simulated treatment processes were able to exceed the treatment expectations even with high nutrient loading and typically sized basins.

The Division had initially thought that setting numeric nutrient limits such that facilities would not have to depend on supplemental chemicals would provide a level a nutrient removal commensurate with the combined goals of Regulation #85 and Regulation #31. By relying solely on biological treatment, the Division felt that significant beneficial progress could be made to reduce nutrients while providing time to collect additional ambient data to use to refine the approach in the future. In the end, given the additional published information and model data, chemical feed systems may be a requisite under specific design or loading conditions to enable treatment facilities to meet the proposed limits in the July version of Regulation 85.

Due to the specific circumstances that would require chemical addition to meet the proposed technology-based numeric nutrient limits, the Division believes that the number of impacted wastewater treatment facilities in Colorado may be relatively small. For those facilities that require the addition of chemicals to enhance nutrient treatment, the chemical addition facilities can be used as a stepping stone toward more robust treatment options in the future.

4.2.1 Process Results in Similar Region 8 State

Colorado and Montana share many of the same water quality and treatment challenges due to the seasonal water and air temperatures, clean headwater stream quality, variable topography, land and water uses. As such, the Division reviewed the status of the technology-based numeric nutrient criteria process in Montana and found that the Montana has currently finalized Senate Bill No. 367 to implement technology-based numeric nutrient standards of 1 mg/L for TP and 10 mg/L for TN measured on a monthly average basis for facilities designed to receive greater than 1MGD and for facilities designed to receive less than 1 MGD, Montana is implementing technology-based numeric nutrient standards of 2 mg/L for TP and 15 mg/L for TN measured on a monthly average basis. Knowing that the two states face similar challenges, the Division considered whether these same technology-based numeric nutrient limits might be applicable for use in Colorado.

While the Division did not find a supporting document discussing how the proposed technology-based numeric nutrient criteria were developed by Montana, the Division considered the limits against the literature based technology-based numeric nutrient limits published in the February 2011version of Regulation 85. Montana has proposed monthly averages for nutrients instead of an annual median as proposed by the Division. At this point in the process, monthly averages for compliance have not been considered for Colorado. The Division still supports the well

documented TPS system for establishing nutrient standards on an annual basis. The TPS method compels treatment for nutrients, which are not toxic compounds, while providing a defensible compliance buffer for process upsets that are expected to occur. Faced with a single upset, treatment facilities must provide even more diligent nutrient throughout the remainder of the year to maintain compliance.

Montana's proposed limits apply equally to existing and new facilities. The Division has taken a different approach given that it is more challenging to retrofit existing facilities and their owners must be given the opportunity to use existing infrastructure that has significant value.

While Montana's compliance periods are not configured like Colorado's approach, its numeric nutrient limits of 1 mg/L TP and 10 mg/L TN are equal to those the Division has proposed in its July version of Regulation 85. At this point, Colorado has made a technical policy decision to set compliance periods that account for expected biological treatment process challenges. Each state makes these types of decisions based on an overall approach for protecting the quality of its waters. Without knowing the other factors Montana considered in setting its nutrient limits and associated compliance periods, an informed comparison between the two states' approaches cannot be made. Colorado is implementing its technology-based approach as a significant step in reducing nutrient loads along with a robust monitoring requirement to assess where additional progress may be needed. In contrast, if Montana's effluent limits are intended to address the contribution from wastewater treatment facilities for the long term, then a comparison between Colorado's proposed limits and Montana's limits would be out of context.

4.3 Conclusions

The revised technology-based numeric nutrient limits and associated compliance periods published in the July 2011 version of Regulation 85 were built using peer reviewed literature and then modified to compensate for the Colorado specific conditions and concerns. While the actual technology-based capabilities of biological treatment processes were used as the foundation for the limits, the Division recognizes that many uncontrolled factors impact the ability of existing and new wastewater treatment works to meet absolute technology-based numeric nutrient limits. As such, the Division provided flexibility in the numeric nutrient limits and compliance monitoring periods that are achievable and with which the vast majority of facilities will be able to comply. These buffers are reflected in the increased numeric limits and adjusted compliance periods (e.g., from annual average to annual median).

The Division appreciates the stakeholders' and independent consulting engineers' contributions to the process to date. The Division has used the information and comments to better inform the process, help bracket the capabilities of the technology provided, and to adjust the numeric nutrient limits. The Division believes that separating new facilities from existing facilities is

essential to the process. Existing facilities face significantly different challenges when attempting to meet numeric nutrient limits different than their initial design basis. .

At this point in the process of developing Regulation 85 the Division finds that the numeric nutrient limit modification for existing treatment facilities of 1 mg/L TP and 10 mg/L TIN for existing facilities are reasonable., These values are often used nationwide as the starting point for nutrient removal discussions. Likewise, the Division feels confident in the use of these values within the appropriate compliance monitoring periods that are consistent with the concepts addressed by the TPS model.

5.0 FUTURE CONSIDERATIONS

The Division will continue to discuss the issues identified in this paper and any new issues raised in the future with stakeholders in an effort to continue to refine the proposal as necessary. This paper has not addressed the comments that were received after the July version was published as the Division is still digesting that information. The Division will continue to work with the Effluent Limits Sub-Group and other interested parties to address the recent comments and will schedule meetings as appropriate to facilitate that dialogue in the near future.